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MAIN RESULTS OF ATMOSPHERIC FINE STRUCTURE PARAMETER OBSERVATION IN THE LOWER THERMOSPHERE

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The capabilities of the radiometeor method of wind measurement increase with the increase of the transmitted power of radar stations fitted with goniometric systems which enables the observation of shower meteors along with sporadic background. In shower observations the meteor zone reflecting area narrows to the echo surface which is perpendicular to the flux radiant. Favorable conditions are created for singling out atmospheric disturbances in which the wave front is parallel to the echo surface which plays, in this case, the role of a frequency filter. For the first time ever this technique as, developed by TEPTIN and FAKRUTDINOVA, (1975) allowed wave disturbances with periods of $\gtrsim$ 4 minutes to be measured, with about a 99% probability of exceeding the level of the turbulence noise, during the Geminid (1981,1983) and Perseid (1978,1984) showers. Maximum values of such wave disturbance amplitudes were about 15-20 m/s, with lifetimes up to 2 hours.

Long sequences of radiometer observations carried out in Kazan in 1978-1980 have made it possible to study wave disturbances in the time scale interval T = (1-6) h. Analysis of the spectral density of the zonal and meridional component disturbances in the (N,S) and (E,W) observation areas averaged over the period from August 30 to September 9, 1978, for four time intervals during the day, showed a disturbance intensity increase in the second half of the day, especially in the period from 12:00 to 18:00 o'clock.

Fig. 1 presents spectral density curves for the winter period of observation (on January 19, 1979). The horizontal line shows the level of turbulent noise with the probability of about 99%. There are significant differences in the disturbance spectra of zonal and meridional circulation as well as in those of each component, the observation regions being spaced about 400 km from each other in the case of meteor zone sounding in the (N,S) and (E,W) directions.

The dependence of the disturbance intensity behavior on time of day and season has been investigated using the observational data of 1980. It was found that for the zonal and meridional components of wind velocity significant peaks in the spectral density curves are observed in all seasons. Diurnally, the disturbance intensity increase is observed in the second half of the day. Seasonally, there is a tendency for disturbance intensity to increase from January to June. Disturbances with time scales T< 3 h make deep mesometeorological minimum in the movements spectrum observed in the lower troposphere about one hour less pronounced in the lower thermosphere. This confirms our earlier (1969) observation results (SIDOROV and FAKHRUTDINOVA, 1981). Wave disturbances modulation is noted in the interval (period) of IGW disturbances on a meteorological scale.

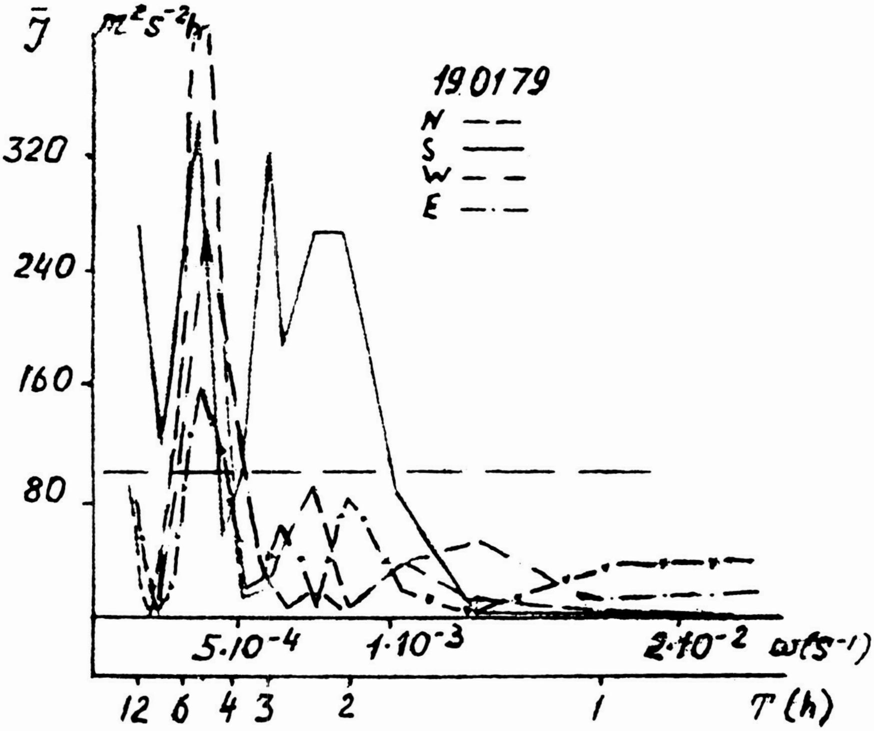

Fig. 1 Spectral density of prevailing wind disturbances for four areas of the meteor zone.

IGW singling our was done during observation periods using altimeter in summer (August, 1983) and winter (December, 1983). The spectral density change with height in the scale interval of 0,5-4 hours according to observations on August 11, 1983, (from 00.00 to 04 hours 30 minutes) is shown in Fig. 2. Disturbances with periods T = 0,5, ~ 1 h are given. Their intensity increase with height is well marked. The phase change with altitude is quasi-linear. The parameters of the singled out wave disturbances are as follows:

August 11, 1983.

$T \simeq 0,5$ h, $\lambda_z \simeq 11$ km, $\lambda_h \simeq 150$ km, $V_z \simeq 5$ mps, $V_h \simeq 85$ mps

$T \simeq 1$ h, $\lambda_z \simeq 12$ km, $\lambda_h \simeq 360$ km, $V_z \simeq 3$ mps, $V_h \simeq 100$ mps

December 13, 1983.

$T \simeq 1$ h, $\lambda_z \simeq 9$ km, $\lambda_h \simeq 360$ km, $V_z \simeq 3$ mps, $V_h \simeq 100$ mps

December 28, 1983.

$T \simeq 3$ h, $\lambda_z \simeq 27$ km, $\lambda h \simeq 450$ km, $V_z \simeq 3$ mps, $V_h \simeq 42$ mps

As a result, the disturbance intensity decrease has been found in the 90-94 km layer for T = 1 h (as revealed by observations on August 11, 1983) and in the 94-97 km layer for T = 3 h (from observations on December 28, 1983). This disturbance intensity behavior is presumably connected with wave energy absorption at the indicated altitudes.

Altitude profiles of the zonal and meridional prevailing wind components have been measured in both summer and winter periods. The zonal component data are presented in Fig. 3. The profiles show a considerable altitude wind inconstancy up to the wind reversal. It is significant that in the meteor zone there are layers moving in opposite directions stretching horizontally within the range of the measuring aerial polar diagram. Altitude gradient values reach 0,05 s^{-1}, increase with height and decrease with time from 0 to 4 o'clock in the morning.

The altitude profiles of ambipolar diffusion coefficient for summer and winter differ. This can be related to seasonal temperature changes. The change of the ambipolar diffusion coefficient with altitude from summer to winter is in keeping with a scale H height increase of the homogeneous atmosphere from 5.13 km up to 7 km. These changes of H can be accounted for by a possible temperature increase in winter in the lower thermosphere.

References

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2. Teptin, G.M., Fakhrutdinova, A.N., 1975, Determination methods and results of motion energy spectral density measurements in the upper atmosphere for the time interval of 5 minutes to 12 hours, in Radiowaves Meteor Propagation, Kazan, the Kazan State University Publishers, Nos. 10-11, pp. 42-48.

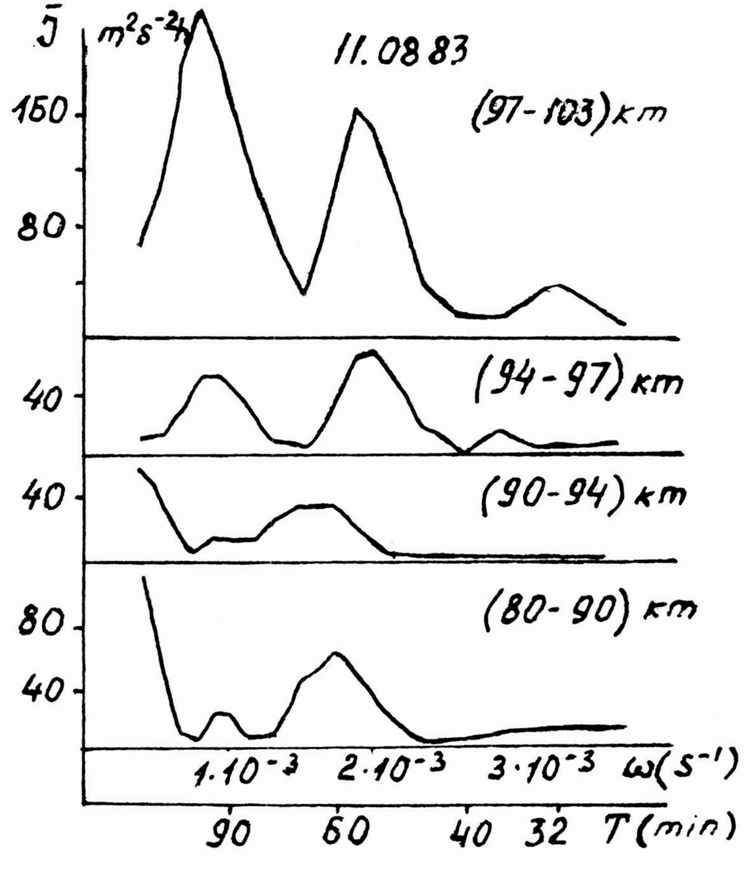

Fig. 2 Spectral density altitude variations.

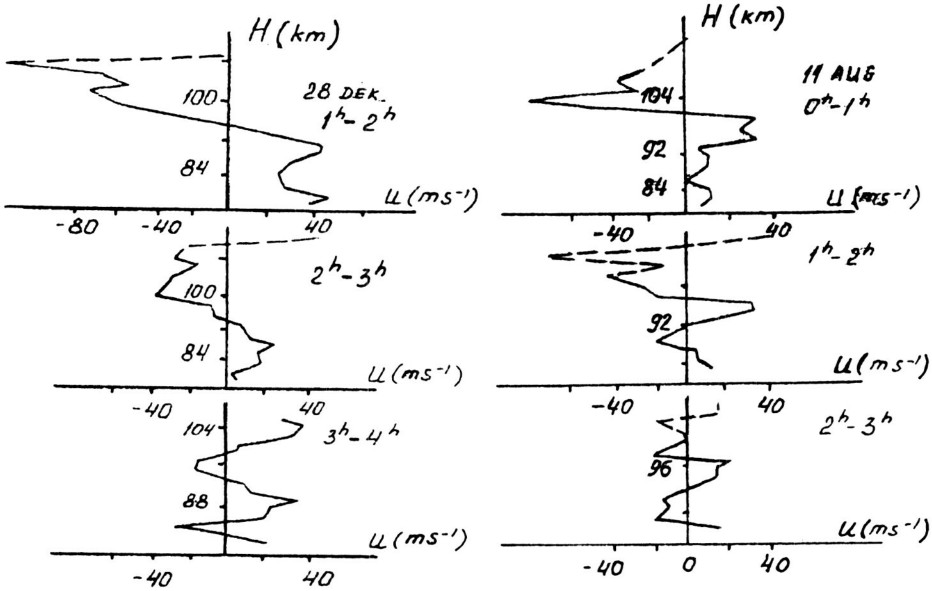

Fig. 3 Prevailing wind zonal component altitude variations in summer and winter.